Parallel Photographs of the Spectra of the Sun, of Iron, and of Iridium, from the Line (H) *to near the Line* (D), *in six sections. Also separate Photographs of the Spectrum of Titanic Iron Ore, in six sections.* By Frank M'Clean, M.A.

The photographs of the solar and metallic spectra now brought before the Society follow the same scheme as the "Photographs of the red end of the Solar Spectrum," presented by the writer in December 1888.

The division into sections and the scale (approximately) are the same as in Ångström's Normal Solar Spectrum. This plan has the advantage of always presenting the spectra in the same familiar divisions, and also of rendering these divisions suitable for direct comparison with Ångstrom's chart.

The present photographs comprise, in the first place, the first six sections of the solar spectrum numbered I. to VI. Taken along with the seven sections comprised in the "red end of the solar spectrum" previously given, and numbered 7 to 13, they complete the whole visible solar spectrum, from (H) to (A).

The present six sections of the solar spectrum are accompanied by corresponding and parallel photographs of the spectra of metallic iron, and of metallic iridium.

The iridium spectrum was fixed upon in order to obtain a full spark spectrum of air, for purposes of comparison. It shows Kirchhoff's iridium lines at wave-lengths 5299 and 5450. It also shows other unregistered lines, either of iridium or of air, which however can only be identified correctly when photographs of further spectra have been obtained. The air lines are present, more or less distinctly, in all spark spectra taken in air, and they supply a ready and accurate means of co-ordinating such spectra with the iron spectrum and with each other.

The iron spectrum was fixed upon on account of its close correspondence throughout with the spectrum of the Sun, and its thus furnishing the best means of co-ordinating the spectra of the other metals with the solar spectrum. The reference of the metallic spectra to the scale of wave-lengths established by Ångström's Normal Solar Spectrum is thus obtained, and it should be borne in mind that Ångström's spectrum is the only complete spectrum of any kind which has been determined to the scale of wave-lengths by direct observation.

It should be remembered that the photographs are only suitable for filling in the details of the spectra between the standard reference lines. Neither the spectroscope used nor the photographic impression is suitable for the accurate measurement of the angle of divergence between the standard lines themselves. A much more compact spectroscope with graduations and adjustments of the most perfect character would be absolutely necessary for such a purpose. The radical difference between measure-

ments within the field of view and independent measurements of direction is involved. The want of rigidity scarcely avoidable with the long tubes of a spectroscope suitable for photography, although comparatively immaterial in the first case, would be fatal where the observation must be made along the line of collimation of the telescope and the direction accurately determined.

Thalén's determinations of the wave-lengths of the metallic spectra, which accompany Ångström's chart, were not made with a diffraction spectroscope. They were, in fact, Kirchhoff's and Hofmann's determinations of the metallic spectra, and were made with a refraction spectroscope to "Kirchhoff's scale." Thalén transformed them to wave-lengths by means of interpolation, on a curve drawn through a large number of points, whose abscissæ represented the wave-lengths of the lines of Ångström's solar spectrum.

Dr. Huggins' determinations of the "Spectra of the Chemical Elements" were also made with a refraction spectroscope. He proceeded by referring the observed spectrum to the lines of the air spectrum as lines of reference. The measurements were taken to the graduated scale of his own instrument. He determined the position of the principal lines of the solar spectrum to the same scale, but, being foreign to his purpose, he did not establish any more detailed connection between the spectra of the chemical elements and the solar spectrum. There seems, therefore, to be an opportunity for the co-ordination of the metallic spectra, by means of the direct comparison of photographs taken with the diffraction spectroscope, with Ångström's standard wave-length chart of the solar spectrum. The writer purposes, if possible, to continue the present series of photographs of the metallic spectra with this object in view.

The striking coincidence of the spectrum of iron with the solar spectrum is of course well known. But to many it is only hearsay knowledge. The present photographs display it to the eye itself, and they carry with them a conviction due to their being the self-recorded images of the phenomena themselves. Attention may be directed to Section V. as particularly rich in coincidences, including the double (E) line with components under one tenth-metre apart. The curious double character of nearly all lines at the violet end of the spectrum is shown in Sections I. and II., although on reaching (H) the definition of the spectroscope somewhat fails.

The same six sections of photographs of the spectrum taken between electrodes of iron and ilmenite (or titanic iron ore), mounted on loose slips, accompany the bound photographs, in order to illustrate the way in which the photographs can be compared with each other, and with Ångström's chart. If Section IV. of these slips be compared with Angström's, the presence in the titanic iron ore, of titanium, chromium, cobalt, and calcium, is at once apparent. Magnesium and barium are also

shown by other sections. The same specimen of ore has unfortunately not been used for all the sections.

It is hoped eventually to extend the metallic spectra to three further sections, thus including the Fraunhofer line (C). But as this must be a much more laborious undertaking it has been for the present postponed.

As before, the photographs have been taken with a Rutherford grating ruled 17,296 lines to the inch, and about $1\frac{3}{4}$ inch square, and they have been enlarged from the original negative about $8\frac{1}{2}$ times.

The writer is unaware of any photographs of the metallic spectra, below the (H) group of lines in the violet, having hitherto been produced to the large scale of the present photographs.

The photographs which accompany the Paper have been placed in the Library.

Note on Terby's White Spot on the Ring of Saturn.
By A. A. Common, F.R.S.

On March 6, at 9.12 P.M., Dr. Terby at Louvain, using his 8-inch telescope, saw what he announced as a white spot on the ring of *Saturn* near the shadow of the planet. Subsequent observations confirmed this appearance to him, and since his observations were announced other observers in different parts of the world have been able to see a white spot on the rings.

On March 6 the 5-foot reflector at Ealing was in use on *Saturn* for several hours, including the time at which Dr. Terby first saw this white spot. Details of the markings on the planet and rings were noted, special attention was paid to the shadow (of the planet), which was seen to be irregular in outline, but nothing in the nature of a bright spot near it was noticed. The positions of the satellites were noted at 9 o'clock, and at 9.30 it was noted that *Mimas* was visible, although not clear of the ring in either case. The first information received at Ealing of Terby's white spot was a telegram from Aberdeen on March 14. "Terby announces région blanche sur anneau *Saturne*, contre ombre globe." Next day *Saturn* was observed with the 5-foot; the white spot was specially looked for, the ring was carefully examined all over, but nothing unusual could be made out. *Saturn* has been observed on ten other evenings since then by Mr. Taylor and by myself, but in no case has any definite white spot been seen.

The ring near the shadow always appears slightly brighter by contrast than the other portions of the ring do; and this effect is found to be much more marked with the 6-inch refractor than with the 5-foot reflector. A dark wedge has been used on many occasions since March 14 by Mr. Taylor and myself on the 6-inch telescope and on the 5-foot, and in every case we have